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Thesis

THE CONSTRUCTION AND EVALUATION OF A DIAGNOSTIC TEST ON MAP SKILLS FOR GRADES SIX, SEVEN, AND EIGHT

Submitted by

Harold Wood Littlefield

(B.S. in Ed., Boston University, 1939)

In partial fulfillment of requirements for
the degree of Master of Education

1947

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CHAPTER I

STATEMENT OF THE PROBLEM

The purpose of this thesis was to construct a test that would reveal the ability of sixth, seventh, and eighth grade children to use map reading skills.

Ability to read a map correctly and to get information from it is considered one of the basic study skills. Children should have acquired this skill before they leave the sixth grade, which means the initial teaching must commence at least by the third grade.

If the "One World" concept is to gain solid footing in the minds of the school children, the ability to get correct information from maps must be stressed more than is being done at present. The peoples of the world have been pulled close together by the time factor, if not by distance, and if world relationships are going to improve, people in the different countries must make an effort to understand one another better.

Ability to use maps properly is one of the means to gain knowledge about the other man and his country. Such knowledge is important today and in the not so distant future it will be more important. Two wars within thirty years have given stimulus to the study of man and his environment

and yet the armed forces found a large portion of young men weak in the ability to use maps.[1] In part, at least, the schools must have failed to do their job. Renner says:

> The map is by far the most important of all the major visual instruments in education, much more important than sound film. It holds this rank because of its priority value in concept building, and because of its variety of uses. Nevertheless, it is the most neglected of all the so-called visual aids. [2]

Brooks in her thesis says :

> We know that children must be taught to speak correctly, to read fluently and to write acceptably. Similarly, they must be taught to read and to draw deductions from maps. It is not a skill which can be assimilated casually along with the many other phases of social studies teaching. [3]

If the schools have failed to teach properly the required skills for map interpretation, just where and to what extent have they failed ? The objective can only be achieved through measurement, which is the purpose of this thesis.

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[1] H.K. Hutter, "Mistakes Made in Geography by Beginning Air Corps Cadets," *Journal of Geography*, Volume 43:108-111, March, 1944.

[2] George T. Renner, "The Map as an Educational Instrument," *Social Education*, Volume IV, Number 1, 1940, p. 477.

[3] Winifred Brooks, "Exercises in Map Interpretation," unpublished Master's Thesis, Boston University, School of Education, 1946.

CHAPTER TWO

REVIEW OF RESEARCH

In 1931, the Bureau of Research in New York City conducted a test on map reading ability.[1] The test was administered by the Bureau to pupils in grade 8-B in one section of the city. The test consisted of 52 questions: 13 on latitude and longitude, 5 on direction, 16 on the use of the legend or key, 6 on interpretation of special maps showing rainfall, 12 on reasoning out probable effects from causes revealed by a map.

The following are sample questions:

1. Finding the latitude of a place on or very close to a parallel shown on a map.
2. On a map where the North Pole is at the center. What direction is it from the Pole to given points ?
3. Using the key showing the scale. Estimate the distance between two points to the nearest hundred of miles.
4. Name the color used to represent a certain altitude.
5. Find the capital of a country.
6. Compare the times in two places through reading a map showing the time belts of the United States.

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[1] The Bureau of Research, New York City, "Testing Map Reading Ability," *Journal of Geography*, Volume 30:38-42, January, 1931.

The test questions were all of the multiple choice type, the pupils working on maps provided for them. The following comments were made by the Research Bureau:

> In general the pupils do well with questions about directions if North is toward the top of the map, East to the right, South to the bottom and West to the left. Results on directions depended greatly on how the questions were asked. Take the following question as an example. Suppose that point A is south of point B. If the question is asked, "What point is directly south of B," more then 90 per cent of the pupils got it right. If the question was phrased differently and asked, "What direction from B to A," the results were much poorer. Questions covering the North Polar map bring poor results. One question asked on this map brought only twenty-eight per cent correct answers. To most of the children North is always up. Questions covering the scale indicated a certain degree of familiarity with the scale but also an inability to use it accurately. The use of color for representing elevation is pretty well understood. However, ability to estimate rate of change in altitude is not too well developed. Questions on map symbols were fairly well handled particularly in locating capitals. The best results were obtained on the special maps, most of the children doing well on these questions.

In the final analysis the Research Bureau felt that the skills tested were abilities to interpret rather directly conditions revealed by the map. The test did not ascertain whether the deficiencies were due to an inability to interpret map symbols or to a lack of knowledge of geographical principles. The Bureau made the suggestion that tests of power should be based upon maps of hypothetical land bodies rather than from existing places so as to remove the possibility of answering from memory.

George F. Howe[1] gave a test to pupils in grades five and six. Its purpose was to find if elementary school children are developing the necessary skills for the understanding of maps. The test that Howe gave covered the following:

1. Ability to read and apply symbols shown in the key or in the margin.
2. Ability to read and apply latitude and longitude.
3. Ability to know direction.
4. Ability to use the scale and estimate mileage.
5. Ability to read inscriptions such as height above sea level.

The following are some sample questions taken from Howe's test:

1. What is the latitude of Philadelphia ?
2. What type of region covers the most space on this map ?
3. How many miles from Cleveland to Chicago ?
4. What line of longitude passes through Cape Cod ?
5. How many people per square mile are shown by the black coloring ?
6. How much rainfall does Connecticut have ?
7. What is the capital of the Province of Saskatchewan ?
8. In what direction is Iceland from Greenland ?
9. What is the largest city in section C.5 ?
10. Name the city nearest 70 degrees west and 43 degrees north.

---

[1] George F. Howe, "A Study of the Ability of Elementary School Pupils to Read Maps," The Thirty-Second Yearbook, National Society for the Study of Education, Public School Publishing Company, Bloomington, Illinois, February, 1933, pp. 486-492.

Most of the questions, according to Howe, involved a multiplicity of skills or knowledge, failure in which may have caused error.

Abrams found on checking question 14 of the June, 1927 Regents' examinations in Geography that in a majority of cases there was a total disregard of the use of parallels and meridians, and the map was read as if in all cases North was directly toward the top of the map.1/

Thorp gave a series of tests in the form of graded exercises to four types of schools: rural, consolidated, village, small city and large city.2/

There were 556 pupils tested between the ages 9 to 14 and from grades 4 through 8. Only 50 per cent of these were from English-speaking homes. To provide an element of control in the situation an experimental sixth grade was given six weeks intensive drill on map work and then given the tests along with the other children. The results were given in tables with percentages of correct, incorrect, and omitted answers. Thorp's tests covered:

1. General globe factors
2. Understanding of latitude
3. Use of the scale
4. Understanding and use of the legend
5. Use of graphs and special maps

1/ A.W. Abrams, "Observations on Answers to Question Fourteen of the June, 1927 Regents Examination," _Bulletin to the Schools, The University of the State of New York_.

2/ Mary Tucher Thorp, "Studies of the Ability of Pupils in Grades Four, Five, Six, Seven, and Eight to Use the Geographic Tools," _Thirty-Second Yearbook, National Society for the Study of Education_, February, 1933, pp.494-507.

Thorp in her analysis said:

> The results show very clearly great deficiencies at all grade levels, but the experimental group made an excellent showing.

Thomas did some work on the ability of children to interpret graphs.[1] Thomas used five types of graphs in her tests:

1. The circle graph
2. The two dimension diagram
3. The horizontal bar graph
4. The multiple picture graph
5. The line graph

The questions asked about each graph involved:

1. The reading and marking of rank.
2. Use of the key.
3. Interpretation of significant data.

The type of questions asked were like the following :

1. What country produces the most wool?
2. How many acres are there in an average farm in Indiana ?
3. What country raise the most wheat ?
4. Does Canada have more boats than the United States ?

The test was given to 355 children in the 4th, 5th, 6th, and 7th grades. Three classes representing slow, average, and superior children were tested in each grade. The same graphs were used in all grades so a reading and arithmetic problem

---

[1] Katheryne C. Thomas, "The Ability of Children to Interpret Graphs," Thirty-Second Yearbook, National Society for the Study of Education, February, 1933, pp. 492-494.

developed in the lower grades, particularly the fourth. Thomas found that all pupils found it easy to rank from the pictorial graph, two dimension and circle graphs. The line graph was difficult for all grades. The fourth graders need graphs especially adapted for them.

One of the big problems encountered in constructing a test on map skills is how to eliminate terms that may lead to errors even though the pupil may possess the requisite skill. Stapleton has done considerable work in listing these sources of error.1/ Stapleton combed the texts for map terms and compiled a total of 502 terms. Of this number, 132 or 25 per cent were used in all texts and Stapleton estimated that a total of 400 terms needed to be mastered by the elementary student before maps could be correctly interpreted.

Aitchison found that grade children develop misconceptions on the terms of the different zones: torrid, temperate, frigid.2/ Aitchison gave a test to 1110 pupils in the sixth, seventh and eighth grades plus some college students. She found that college students have the same misconceptions as

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1/ Mary Ellen Stapleton, "Map Terms Used in Eight Fifth Grade Geography Texts," Unpublished Master's Thesis, Boston University, School of Education, 1946.

2/ Alison E. Aitchison, "Torrid, Temperate, and Frigid Zones, Sources of Error in Children's Thinking." Thirty-Second Yearbook of the National Society for the Study of Education, February, 1933, pages 483-485.

do the grade children, indicating the carryover that takes place. Aitchison's conclusion was that terms such as torrid, temperate, and frigid should be omitted from the texts as a hindrance to clear geographic thinking. She thinks it would be better to introduce such terms as : low latitudes, middle latitudes, and high latitudes.

CHAPTER III

CONSTRUCTION OF THE TEST

In constructing the diagnostic map test the most important task was to compile the skills that a good map reader must possess properly to get information from a map. From this list of skills the test was developed. The first step was to examine all available sources so as to get a comprehensive view of what experts in the field thought were the necessary skills for children to possess.

Uttley lists the following attainments for the fourth, fifth, and sixth grades:[1]

A. Grade IV.

1. To use simple maps; those without latitude and longitude and with few symbols.
2. To read symbols of natural and cultural features.
3. To read direction.
4. To read relationships-- it would be easy to row a boat from point A to point B for it is in that direction the river is flowing.
5. Ability to compare pictures and maps and to read the symbol on the map that represents a particular item in the picture.
6. Ability to use globe or hemisphere maps.
7. To recognize sun behavior lines and direction lines.
8. To know continents by name, and oceans by name.
9. To read direction by North, South, East and West lines.
10. To read comparative distances in regard to location between equator and the poles.

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[1] Marguerite Uttley, "A Provisional Formulation of Attainments in Geography for the Elementary School." Thirty-Second Yearbook for the National Society for the Study of Education. February, 1933, pp. 247-264.

11. To read seasonal conditions associated with distance from the equator.
12. To associate locational facts with human activities.

B. Grade V.

1. To read distance from the equator in miles and degrees.
2. To use the scale for measurement of distance.
3. To use on more complex maps the symbols for cultural and natural items learned on the simple maps of the fourth grade.
4. To read elevation by colors and contour lines.
5. To recognize certain land forms.
6. To read symbols for human items, political boundaries, and capitals.
7. To read distribution, rainfall, temperatures, natural resources, and agriculture.
8. To compare areas on one type map with the same area on other maps.
9. To use round number statistics and graphs.

C. Grade VI.

1. To understand latitude and longitude.
2. To locate places, given the latitude and longitude.
3. To know the time belts.
4. To read graphs in terms of multiple units.

Lange feels that the fifth and sixth grades should know the following:[1/]

1. Knowledge of zones and the names of the lines associated with them.
2. Knowledge of degrees and the number of miles to a degree of latitude.
3. The relationship between latitude and climate.
4. Knowledge of latitude and longitude.

Baker lists the following attainments for elementary children:[2/]

1. Directions using maps with straight and curved parallels and meridians.

[1/] Stella R. Lange, "A Geography Test," _Journal of Geography_, Volume 34:40-41, January, 1935.

[2/] Emily V. Baker, "Diagnosing Children's Ability to Use Maps," _Journal of Geography_, Volume 37:227-231, September,1938.

2. Scale using the same type of maps.
3. Scale using a map with a larger scale and repeating the same question.
4. Scale using a map of the world to find if the children know that the scale cannot be used all over the map.
5. Physical features-- naming peninsulas, islands, harbors.
6. Rivers-- finding the direction of flow.
7. Map legend-- finding cities and arranging them in order of size, finding elevation of land, ocean depth, capitals of countries, railroads, canals, amount of rainfall, density of population.
8. Types of maps--children to name them as they are displayed.
9. Use of color to show physical features, such as water and height of land.
10. Use of symbols.

Shryock lists the following abilities for the fourth, fifth and sixth grades:[1]

A. Grade IV.

1. Knowledge of the equator.
2. Knowledge of the cardinal directions.
3. Knowledge of symbols of semi-pictorial type of natural and cultural features.
4. Knowledge of direction and comparative distance from the equator.
5. Use of one pattern maps.

B. Grade V.

1. Knowledge of physical and political maps.
2. Knowledge of elevation, as shown by color and contour lines.
3. Use of pattern maps showing rainfall, vegetation, density of population, crops, livestock.
4. Ability to compare areas on one map with the same areas on another map.
5. Knowledge of the relationship between topography and the location of industry, population, and agriculture.

---

[1] Clara M. Shryock, "Gradations in Map Learning," *Journal of Geography*, Volume 38:5, May, 1939.

6. Use of the scale.
7. Knowledge of direction.
8. Use of degrees.

C. Grade VI.

1. Knowledge of latitude, longitude and elementary projection.
2. Ability to tell time by longitude.
3. Use of two, three and four pattern maps.

An examination of the texts used in Geography courses did not bring out any different skills than has already been covered in the preceding pages. The standard material in the elementary text books includes:

> Latitude, longitude, location, direction, time zones, legend, scale, distance, graphs, special or pattern maps.

Additions were noted in the newer texts on projections, especially the North Polar maps which are given greatly increased attention.

Brooks[1] and de Grasse[2] have produced some excellent material on map skills and exercises that may be used to teach or to diagnose. The material that they cover and that children are expected to use or to develop skills in are :

> Direction, scale, symbols, hemispheres, continents, oceans, latitude, longitude, time; one, two, three and four pattern maps, graphs, and the North Polar Map.

---

[1] Winifred Brooks, "Exercises in Map Interpretation," unpublished Master's Thesis, Boston University, School of Education, 1946.

[2] Marjorie de Grasse, "Use and Meaning of Maps," unpublished Master's Thesis, Boston University, School of Education, 1946.

The Public School Achievement Test has one section devoted to map work.[1] There are questions on longitude, location, scale, time, the earth's surface and degrees. In all there are but eleven questions based on a map of western Europe and the British Isles.

The Wiedefield-Walther Geography Test, Form A, is for grades four through eight. It is in six parts, the third part on map and graph reading. Test Three measures the following abilities:[2]

1. Recognition of symbols.
2. Recognition of direction.
3. Estimation of area.
4. Location by latitude and longitude.
5. Estimation of distance.
6. Estimation of slope of land and altitude.
7. Fact finding from isohyets and isotherms.
8. Picturing from map symbols.
9. Orientation of maps.
10. Reading relations through comparative use of maps.

The test manual states that: "Graph reading is an essential skill for the attainment of geographical facts and relationships."

The test graph problems measure:

1. Recognition of maxima and minima.
2. Ability to rank facts.
3. Estimation of quantities.
4. Reading of relationships.

---

[1] Public School Achievement Test, Battery B, Form III, Grades Six to Eight. Public School Publishing Company, Bloomington, Illinois, 1930.

[2] Wiedefield-Walther Geography Test, Form A. Grades Four through Eight. World Book Company, New York, 1931.

The Iowa Every-Pupil Tests of Basic Skills is divided into four parts of which Test B is concerned with map skills.[1] The test manual states that the skills involved in map reading for the grades are :

1. Ability to visualize the represented area in its natural plane and to read directions correctly.
2. Ability to recognize and to interpret standard map symbols.
3. Ability to identify and to visualize symbols with the use of a key.
4. Ability to get facts and information from parallels and meridians.
5. Ability to apply physical facts to match situations.
6. Ability to read and to interpret facts from pattern maps.

The manual states that the basic skills necessary to read graphs correctly are:

1. Ability to comprehend from the title the topic on which the graph gives information.
2. Ability to recognize from sub-titles and row or column headings what is shown by each part of a graph.
3. Ability to read amounts from a graph.
4. Ability to compare two or more values read from a graph.
5. Ability to determine trends as shown on a line graph.
6. Ability to realize that percentages do not give absolute amounts.
7. Ability to compare values given in different columns in a table, in order to solve a problem.
8. Ability to grasp the outstanding fact portrayed by a graph.
9. Ability to recognize which one of a number of general interpretations of a graph is correct.
10. Ability to determine rank from an unordered list of numbers.

1/ Manual for Interpretation of Iowa Every-Pupil Tests of Basic Skills, Form L. Houghton,Mifflin Company, Boston, 1940.

The emphasis of the test has been placed on the functional aspects of the skills, not on memory tests.

After an analysis of the skills listed by the various experts the following were selected as being the ones most necessary for the sixth, seventh and eighth grade pupils to know. They are basic for successful map reading and are comprehensive.

1. Recognition of direction.
    a. ability to know directions as expressed in terms of the cardinal and mid-cardinal points.

2. Recognition of scale.
    a. ability to measure distance on maps of different scale and different projection.

3. Recognition of latitude and longitude.
    a. ability to locate and designate points.
    b. ability to associate climate with latitude.
    c. ability to measure distance by changing degrees of latitude to miles.
    d. ability to divide the world into low, high, and middle latitudes and into eastern and western hemispheres.
    e. ability to reckon time by longitude.
    f. ability to associate latitude and longitude with human activities.
    g. ability to divide the world into degrees.

4. Recognition of legend and symbols.
    a. ability to get information from a map's legend.

5. Recognition and use of special maps.
    a. ability to get information from pattern maps.

6. Recognition of graphs.
    a. ability to get information from simple graphs.

The writer recognizes that certain abilities have been left out of his list of skills, but he thinks that these are either less important or may be included as part of those already listed.

In selecting the type of test to be constructed there was a choice of three types: 1. a factual test; 2. a functional test; 3. a combination functional and factual test. The first choice was ruled out because it is based on memory and not on skill, and there is too much opportunity for children to get mixed up on terms they either do not understand, or they misinterpret. The third choice was ruled out because of similar reasons plus the length of the test which would make it unwieldy to handle. The second choice, the functional test, was selected because it seemed to be the fairest method of testing the students, and it allowed the making of a more comprehensive test, utilizing maps of different projections with questions on each type of map.

The maps selected for the test were:the Mercator projection because it is still widely used; an equal area projection with curved meridians and parallels, and the North Polar map. Of the five maps used in the test, two of them show familiar land masses. The prime idea back of the selection of more than one type of map was to find out if the children could use their skills on various projections with equal success.

As to the question of using real or imaginary land forms, the writer,as mentioned above, has used both. It is felt that with the functional type of test and with the type and form of question asked that memory answering is eliminated.

The complete test was made up of six sub-tests, each complete in itself. The sub-tests corresponded to the six skills being diagnosed. Questions on sub-test I (recognition of direction), sub-test II (use of the scale in measuring distance), and sub-test III (recognition and use of latitude and longitude), were based on four different maps so that the pupils would have an opportunity to test their knowledge on more than one type of projection. Because of its length, sub-test III was divided into three parts:

Part A - the ability to locate and to designate points by latitude and longitude.

Part B- the ability to figure time by longitude.

Part C- the ability to divide the world into low, middle, and high latitudes, to recognize climatic changes by latitude, and to divide the world into hemispheres.

Part D- the ability to change degrees of latitude into miles of distance was given under sub-test II. All questions on sub-test IV (recognition and use of legend and symbols), were based on one map. Four special maps or pattern maps were constructed for sub-test V (recognition and use of special maps). These maps gave information on rainfall, products, elevation and population. It was felt that four special maps were sufficient to test the skill of the grade students and more maps would only make the test harder to handle. All questions on sub-test VI (recognition and use of graphs), were based on three types of graphs, the bar graph,

the circle graph, and the line graph. These graphs are commonly used and provide a good test of graph reading ability.

As many items as possible were then constructed for each skill, with a tentative list of 140 questions being compiled. It was kept in mind that there should be a range of item difficulty sufficient to test both the poorest and the best students. There was an attempted range of difficulty from the fourth to the ninth grade. There was to be only a single correct answer for each question.

The test was then given to several teachers for criticism and their evaluation resulted in some minor changes. The test was then given its preliminary try-out, being administered to the writer's sixth grade home room. The students were also to write on a separate piece of paper any comment they had to make on why they failed to answer a question. The evaluation of this trial test showed that many of the items were capable of being answered in more than one way and so needed revision. The maps needed altering in minor ways, particularly in clearness of detail. As the tests were mimeographed, it was imperative that every line be clear cut. Many of the questions and sometimes whole pages were beyond the ability of some of the pupils to answer, but these sections and questions were kept in until more comprehensive testing could be done. The fact that a few of the pupils scored high marks on the test without having any more instruction, showed that the skills were within the grasp of the sixth grade.

The final step was to mimeograph 200 tests and to administer them to different grades to see how well the test measured and which items were significant. The test in its final form before administration had 138 items, two of the original items being eliminated. The maps in design and in number were kept the same as the original.

A Diagnostic Test On Map Skills
For Grades Six, Seven, and Eight

The Basic Skills

1. Recognition of direction
    - A. Ability to know direction as expressed in terms of the cardinal and mid-cardinal points.

2. Recognition of scale
    - A. Ability to measure distance on maps of varying scale and different projection.

3. Recognition of latitude and longitude
    - A. Ability to locate and designate points.
    - B. Ability to measure distance by changing degrees of latitude to miles.
    - C. Ability to associate climate with latitude.
    - D. Ability to divide the world into areas of low, middle, and high latitude.
    - E. Ability to divide the world into hemispheres.
    - F. Ability to divide the world into time zones.
    - G. Ability to associate latitude and longitude with human activities.
    - H. Ability to divide the world into degrees.
4. Recognition and use of legend and symbols
    - A. Ability to get information from maps with symbols explained by a legend.

5. Recognition and use of specialized maps
    - A. Ability to get information from pattern maps giving facts about man and nature.

6. Recognition and use of graphs
    - A. Ability to get information from simple graphs of different types.

Pupil's Name ______________________________ Grade ______
Last First

Pupil's Age ______________________________ I.Q. ______
Years Months

City or Town ______________________________ School ______________

Date ______________________________
Day Month Year

	Possible Score	Actual Score
Sub-Test I		
Sub-Test II		
Sub-Test III		
Sub-Test IV		
Sub-Test V		
Sub-Test VI		
	Total	

A Diagnostic Test on Map Skills

Sub-Test I
Recognition of Direction

Read the directions and questions carefully, then fill in the blank space to the right of the question with your answer.

For the following questions use Map Number One.

1. What is the direction from A to F ? 1. ____________
2. from A to E ? 2. ____________
3. from E to C ? 3. ____________
4. from B to D ? 4. ____________
5. from C to F ? 5. ____________
6. from A to B ? 6. ____________

For the following questions use Map Number Two.

7. What is the direction from B to H ? 7. ____________
8. from F to G ? 8. ____________
9. from C to D ? 9. ____________
10. from K to J ? 10. ____________
11. from B to A ? 11. ____________
12. from C to J ? 12. ____________

For the following questions use Map Number Four.

13. What is the direction from B to A ? 13. ____________
14. from A to C ? 14. ____________
15. from the North Pole to E ? 15. ____________
16. from the North Pole to D ? 16. ____________
17. from C to B ? 17. ____________
18. Which would be the shortest direction from B to F, West or East ? 18. ____________
19. Which would be the shortest direction from D to G, West or East ? 19. ____________
20. What is the direction from E to G ? 20. ____________

Sub-Test II

Use of the Scale

For the following questions use Map Number One.

21. What is the distance in miles from C to B ? 21. ______

22. from B to A ? 22. ______

23. from F to C ? 23. ______

24. from A to F ? 24. ______

For the following questions use Map Number Two.

25. What is the distance from A to B ? 25. ______

26. from H to K ? 26. ______

27. from D to L ? 27. ______

28. from C to D ? 28. ______

For the following questions use Map Number Four.

29. What is the approximate distance from A to C ? 29. ______

30. What is the approximate distance from F to the North Pole ? 30. ______

31. What is the approximate distance from C to F ? 31. ______

For the following questions use Map Number Five.

32. How many miles from city 7 to city 8 ? 32. ______

33. from city 4 to city 3 ? 33. ______

34. from city 5 to city 2 ? 34. ______

Sub-Test III Part A

The Use of Latitude and Longitude

For the following questions use Map Number One.

35. What is the latitude of C ? 35. ______

36. What is the latitude of A ? 36. ______

37. What is the latitude and longitude of F ? 37. ______

38. What meridian of longitude passes through C and F ? 38. ______

39. What is the nearest parallel of latitude to point D ? 39. ______

For the following questions use Map Number Two.

40. What is the latitude of A ? 40. ______

41. What is the longitude of D ? 41. ______

42. What is the point at 57°N 55°E ? 42. ______

43. What is the point at 61°N 7° E ? 43. ______

44. What is the latitude and longitude of C ? 44. ______

45. What meridian of longitude passes through point J ? 45. ______

46. What is the closest parallel of latitude to L ? 46. ______

For the following questions use Map Number Four.

47. What is the latitude of F ? 47. ______

48. What is the longitude of E ? 48. ______

49. What is the latitude and longitude of A ? 49. ______

50. What point is at 70°N 11°E ? 50. ______

51. What point is at 73° N 90°W ? 51. ______

Sub-Test III. Part B.

For the following questions use Map Number One.

52. When it is five o'clock at C, what time will it be at E ? 52. ______

53. When it is three o'clock at A, what time will it be at E ? 53. ______

54. When it is eleven o'clock at A, what time will it be at F ? 54. ______

For the following questions use Map Number Two.

55. When it is twelve o'clock at D, what time will it be at J ? 55. ______

56. When it is five o'clock at J, what time will it be at A ? 56. ______

57. What will be the time at L, when it is four o'clock at F ? 57. ______

For the following questions use Map Number Three.

58. When it is six o'clock on the 60th meridian of longitude, what time will it be on the 75th meridian of longitude ? 58. ______

59. on the 90th meridian ? 59. ______

60. on the 105th meridian ? 60. ______

61. on the 120th meridian ? 61. ______

For the following questions use Map Number Four.

62. When it is one o'clock at A, what time will it be at D ? 62. ______

63. Will it get dark at B before it gets dark at E ? 63. ______

64. How many hours difference in time is there between D and E ? 64. ______

65. When it is twelve o'clock at C, what time will it be at G ? 65. ______

Sub-Test III. Part C.

For the following questions use Map Number One.

66. Which point would probably have the coldest winters, A or D ? 66. ______

67. Which points are in the middle latitude ? 67. ______

68. In what latitudes are A and B ? High, middle, or low ? 68. ______

69. Name one point that is on the equator. 69. ______

70. Are the points on Map Number One in the Eastern or Western hemisphere ? 70. ______

For the following questions use Map Number Two.

71. Are there any points in the low latitudes on Map Number Two ? 71. ______

72. How many points on Map Two are in the Western hemisphere ? 72. ______

73. Which point, A or D, would probably have the coldest winters ? 73. ______

74. Which point, G or K, would probably have the warmest winters ? 74. ______

75. Which point is nearest to the North Pole ? 75. ______

For the following questions use Map Number Four.

76. In what hemisphere are points, A-B-C-D ? 76. ______

77. Is point G in the middle or low latitudes ? 77. ______

78. Are any of the points on Map Four south of the equator ? 78. ______

Sub-Test IV.

Use of Legend and Symbols

For the following questions use Map Number Five.

79. Is city 8 upstream or downstream from city 2 ? 79. ______

80. Is city 8 upstream or downstream from city 6 ? 80. ______

81. Through how many states does the river starting at the boundary of state F pass ? 81. ______

82. What city is located at the shore of the lake? 82. ______

83. What is the population of this city ? 83. ______

84. In what state is the largest part of the lake located ? 84. ______

85. How many rivers enter the longest river ? 85. ______

86. Which city is located on the river delta ? 86. ______

87. What is the population of this city ? 87. ______

88. How many hills are shown on Map Five ? 88. ______

89. What is the height of the highest hill ? 89. ______

90. Name one state that borders on the ocean. 90. ______

91. Which city is located on a peninsula ? 91. ______

92. At what city do the railroads meet ? 92. ______

93. Is city 1 larger or smaller than city 3 ? 93. ______

94. How many cities are larger than city 7 ? 94. ______

95. Which city is surrounded by hills ? 95. ______

96. Which state has only one hill ? 96. ______

97. Is city 5 near the beginning or end of a river? 97. ______

98. Which city is located on a bay ? 98. ______

Sub-Test V
Use of Pattern Maps

For the following questions use Pattern Maps, One, Two, Three and Four.

99. Which state ranks first in population ? 99.______

100. How does state C rank in population ? 100.______

101. What is the most important economic activity in state A ? 101.______

102. Which state has a large amount of desert land ? 102.______

103. Does state B do any manufacturing ? 103.______

104. Which state does the most farming ? 104.______

105. Does this state also get the most rainfall? 105.______

106. How many inches of rainfall does state F get in a year ? 106.______

107. Which state has the highest elevation ? 107.______

108. Name one of the most important economic activities in state C. 108.______

109. Name one state that does some shipbuilding. 109.______

110. What state gets the smallest amount of rain? 110.______

111. What is the highest elevation in state E ? 111.______

112. Which state has the most cattle and sheep? 112.______

113. Which state has the smallest population ? 113.______

114. Does state A do any lumbering ? 114.______

115. Which state, A or E, gets the most rain ? 115.______

116. Does state F have more or less people than state E ? 116.______

117. Which state has the lowest elevation, C or F? 117.______

118. Which state has ground below sea level ? 118.______

119. How far below sea level does the ground go? 119.______

Sub-Test VI

Use of Graphs

For the following questions use Graph One.

120. What country used the smallest amount of sugar per person ? 120. ______

121. What country used the most sugar per person?121.______

122. How much more sugar per person did country A use than country B ? 122. ______

123. How many pounds per person did country C use ? 123. ______

124. Did countries B and E together use more than A ? 124. ______

125. What country used about as much sugar as C and D together used ? 125. ______

For the following questions use Graph Two.

126. What farm crop does this graph give information about ? 126. ______

127. What country grew the most wheat ? 127. ______

128. Which country was second ? 128. ______

129. Which country grew 5% of the world's wheat ? 129. ______

130. How much more wheat did B grow than D ? 130. ______

131. Did D and E together grow more wheat than C? 131. ______

132. What percentage of the world's wheat did all the other countries grow ? 132. ______

Sub-Test VI (concluded)

Use of Graphs

For the following questions use Graph Three.

133. What was the country's population in 1860 ? 133. _____

134. What was the approximate population in 1930? 134. _____

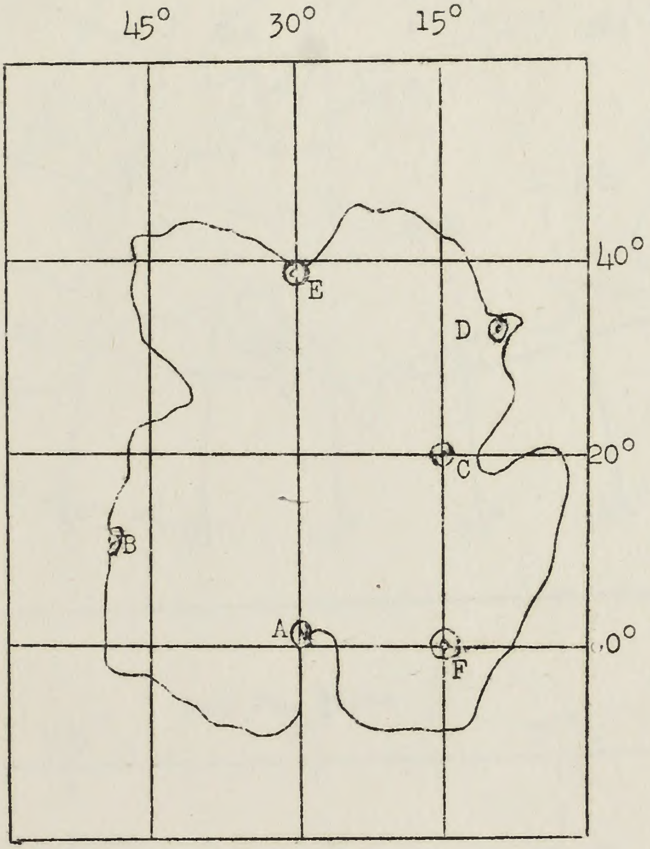
135. Which period of forty years showed the most gain in population ? From 1860 to 1900, or 1900 to 1940 ? 135. _____

136. What is the expected population by 1960 ? 136. _____

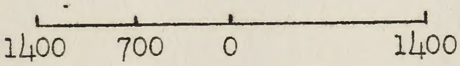
137. About what year did the country reach 50 million population ? 137. _____

138. What period of 40 years shows the smallest gain in population ? 138. _____

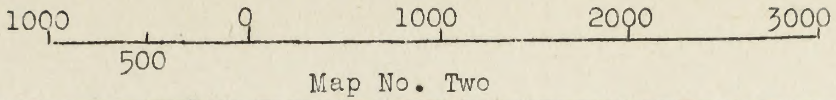
Map No. One



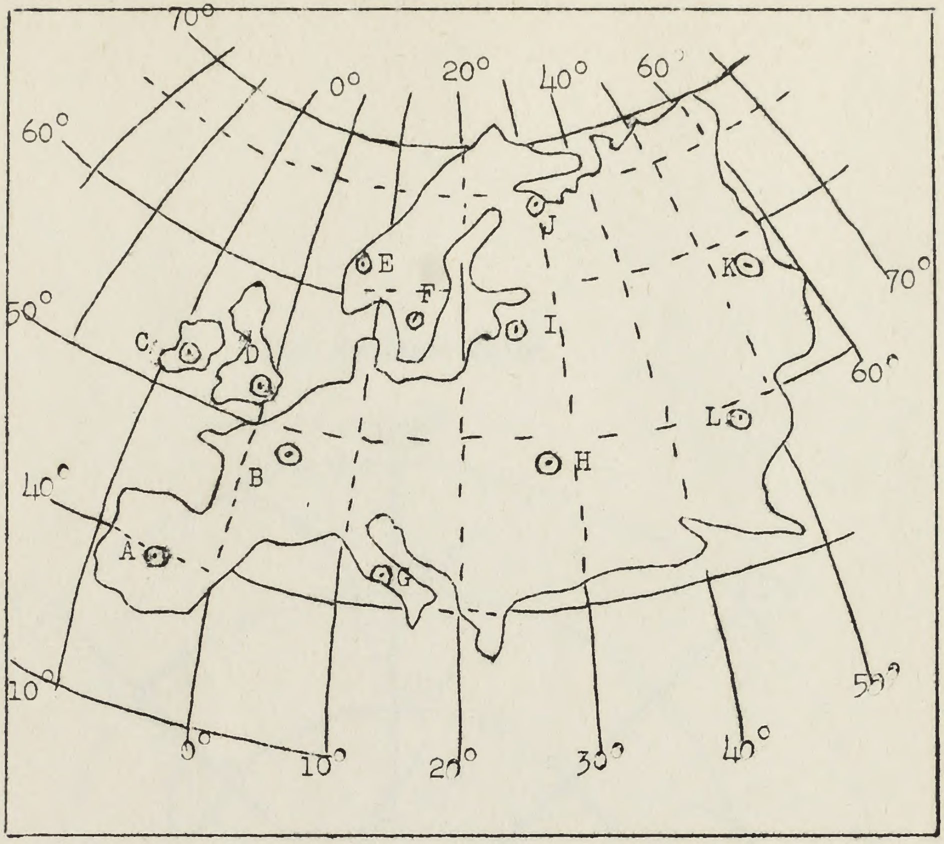
Scale of Miles



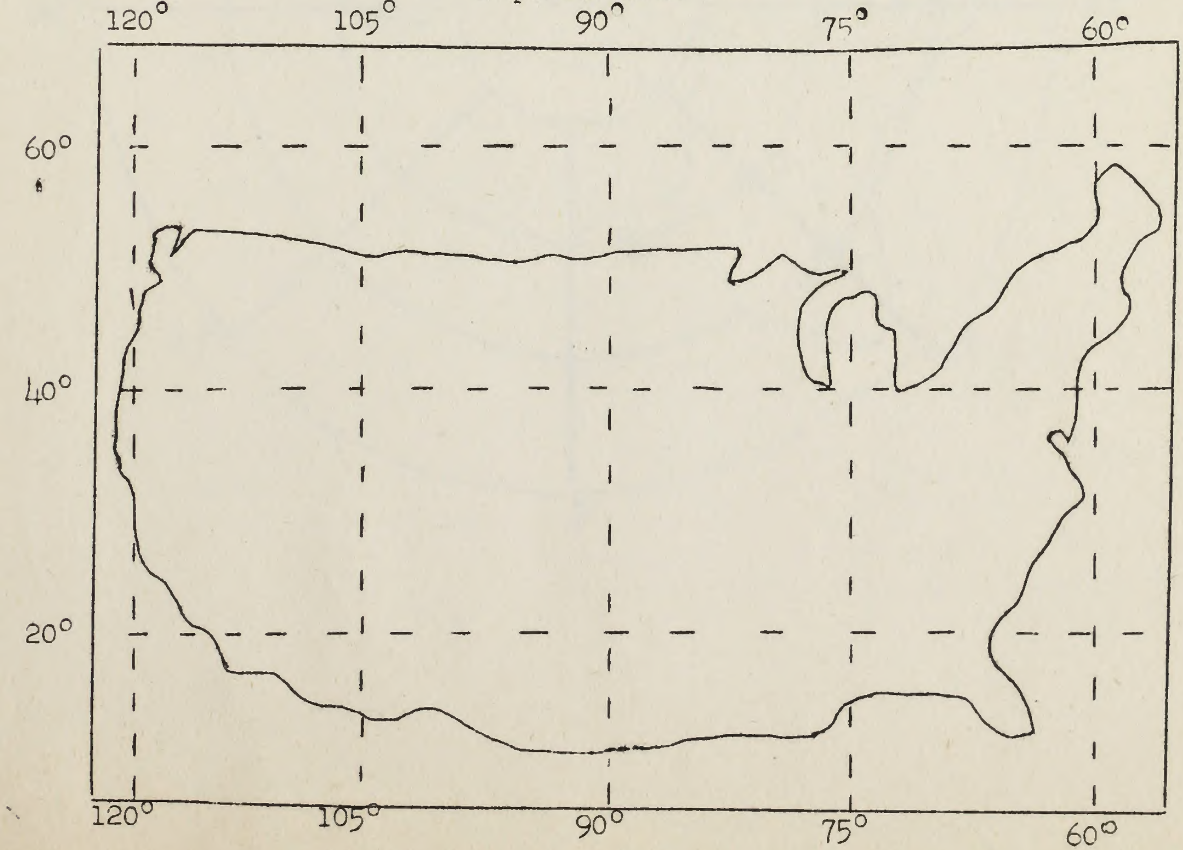
Scale of miles-One inch equals 1000 miles



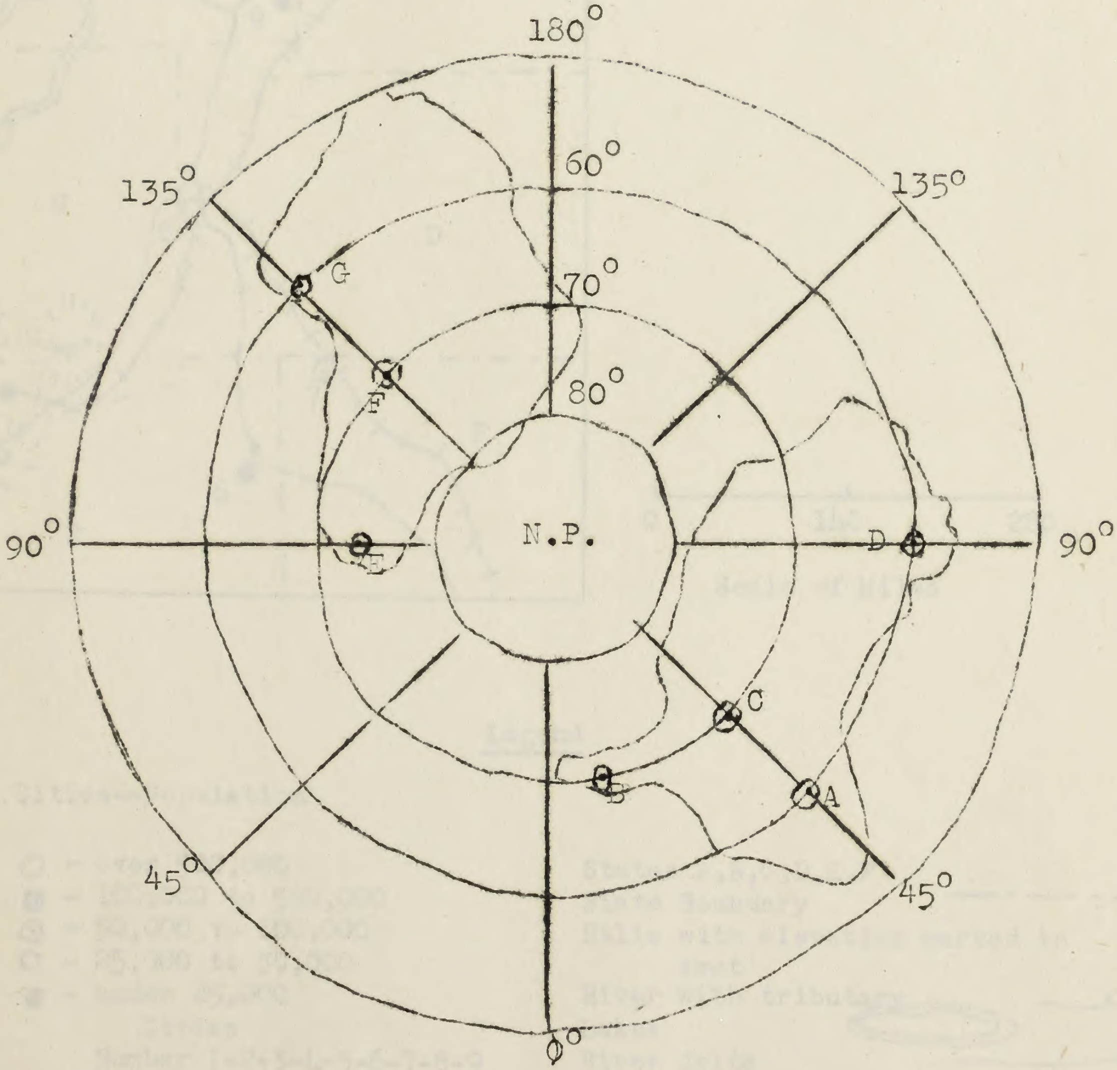
Map No. Two



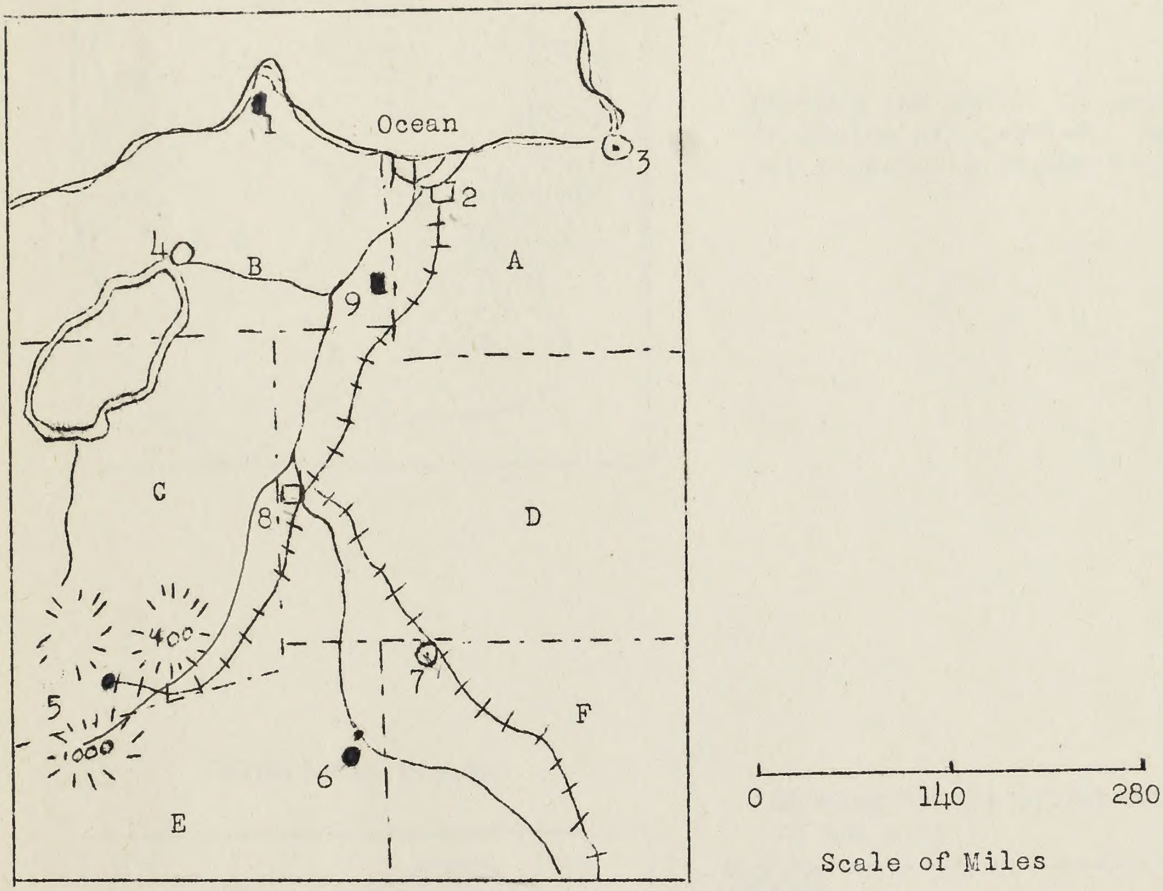
Map No. Three



Map Number Four



Map No. Five



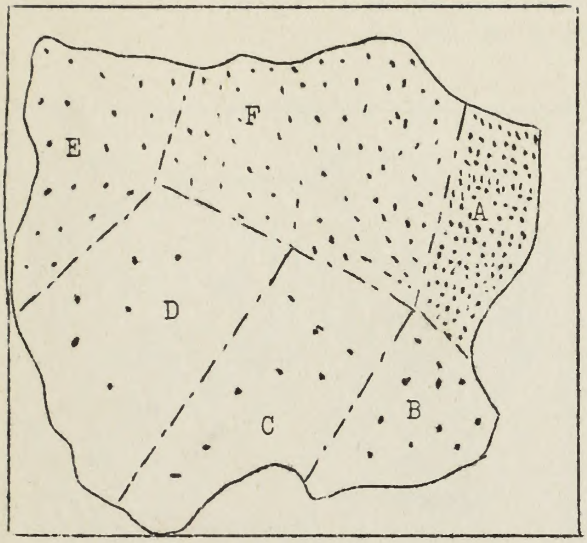
Legend

Cities--Population

□ - over 500,000
■ - 100,000 to 500,000
⊙ - 50,000 to 100,000
○ - 25,000 to 50,000
● - under 25,000
Cities
Number 1-2-3-4-5-6-7-8-9

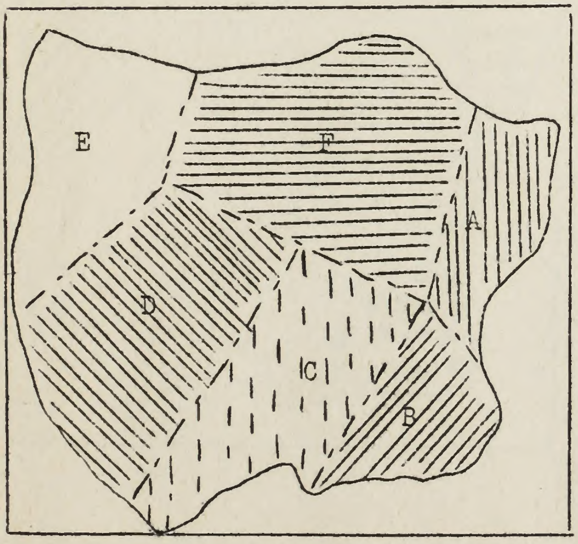
States A,B,C,D,E,F
State Boundary — · — · —
Hills with elevation marked in feet
River with tributary
Lakes
River delta
Railroad ┼┼┼┼┼┼┼
Coastline

Pattern Map No. One



Showing the number of people in States A-B-C-D-E-F. Each dot represents 10,000 people.

Pattern Map No. Two

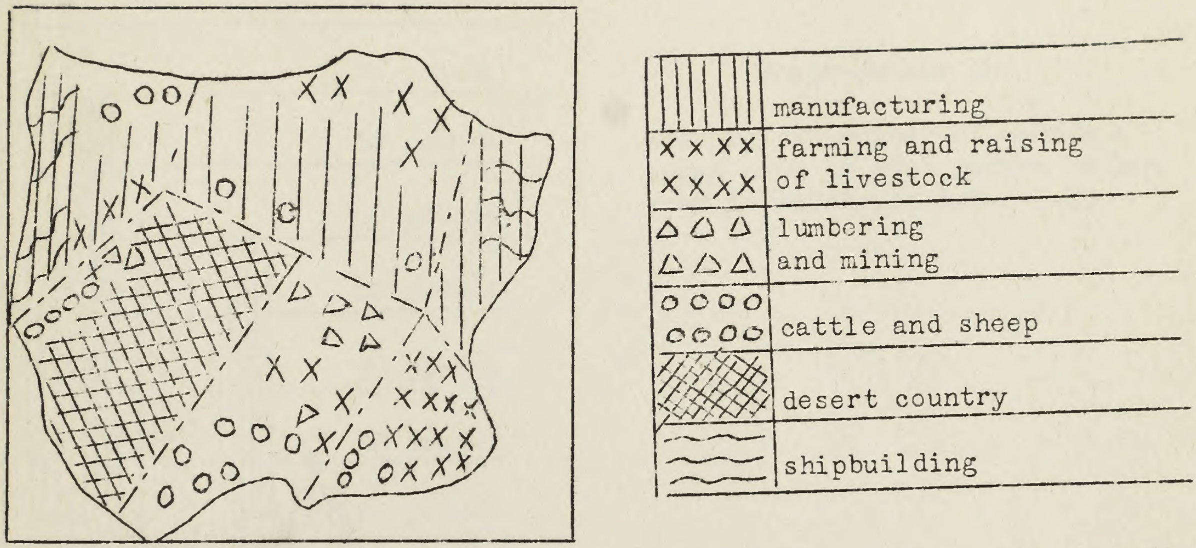


Showing inches of rainfall in one year.

▨	over 80 inches
¦	from 60 to 80 inches
▥	from 40 to 60 inches
▤	from 30 to 50 inches
	from 20 to 40 inches
▧	under 20 inches

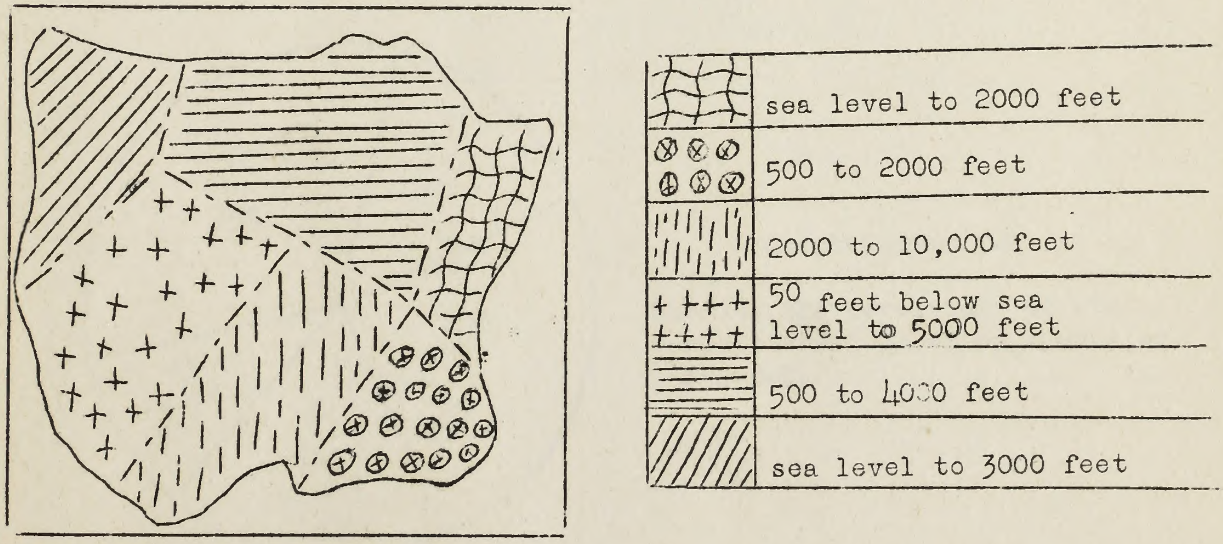
Pattern Map Number Three.

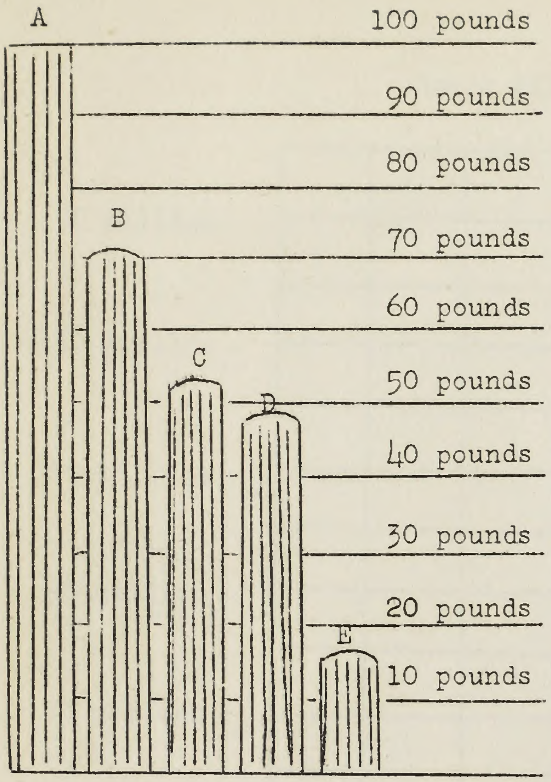
Showing economic activities
in states A-B-C-D-E-F.



Pattern Map Number Four.

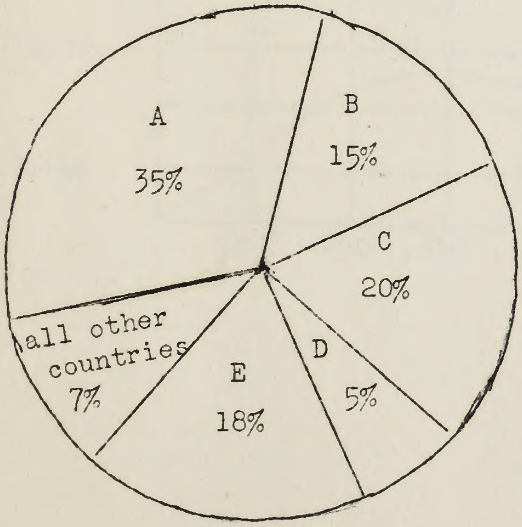
Showing elevation of land
in states A-B-C-D-E-F.





Graph-Number One

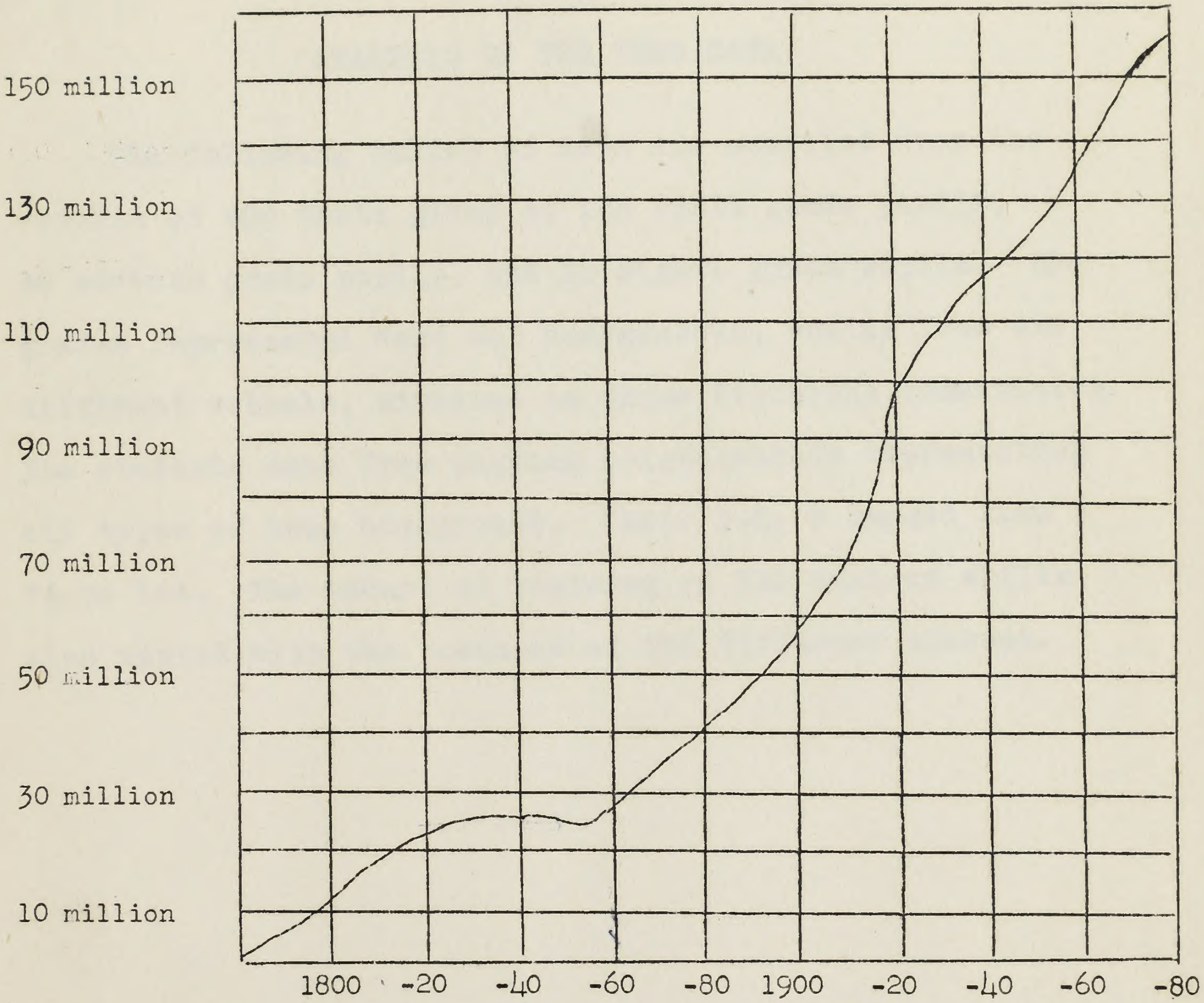
Showing the number of pounds of sugar used by each person in one year in countries A-B-C-D-E.



Graph-Number Two

Showing the percentage of the world's wheat grown by countries A-B-C-D-E.

Graph III. Showing a country's growth in population



CHAPTER IV

ANALYSIS OF THE TEST DATA

The following tables of data are compiled from the results of 200 tests given to 125 sixth grade pupils, 50 seventh grade pupils, and 25 eighth grade pupils. The grades represented were not homogeneous, coming from six different schools, situated in three different communities. The students came from varying neighborhoods representing all types of home background. Their I.Q.'s ranged from 74 to 144. The amount of training on the various skills also varied with the teachers of the different classes.

TABLE I
RANGE OF SCORES AND THE MEDIAN OF EACH GROUP

Scores Grade	6a	6b	6c	(6d-6e)	7a	7b	8a	Total
118-122	0	1	0	0	0	0	0	1
113-117	1	0	0	0	0	0	1	2
108-112	2	0	0	0	0	0	0	2
103-107	1	1	1	1	1	0	1	6
98-102	3	4	0	2	2	0	0	11
93--97	4	2	1	2	2	1	1	13
88--92	4	0	1	3	6	0	1	15
83--87	3	1	5	7	5	0	6	27
78--82	2	1	2	2	3	0	8	18
73--77	2	5	3	2	2	2	4	20
68--72	0	1	4	4	2	2	3	16
63--67	0	2	1	5	0	2	0	10
58--62	0	2	2	3	1	3	0	11
53--57	0	1	1	3	0	1	0	6
48--52	0	1	2	3	1	3	0	10
43--47	0	0	0	2	0	4	0	6
38--42	0	1	1	5	0	1	0	8
33--37	0	2	0	2	0	3	0	7
28--32	0	0	1	0	0	1	0	2
23--27	0	0	0	2	0	1	0	3
18--22	0	0	0	0	0	0	0	0
13--17	0	0	0	1	0	0	0	1
8--12	0	0	0	0	0	0	0	0
3---7	0	0	0	1	0	0	0	1
Median	92.5	75.0	73.3	65.5	85.1	50.0	81.0	76.8

TABLE II A

RANGE OF SCORES AND THE MEDIAN OF EACH GROUP ON SUB-TEST I

Scores	6a	6b	6c	6d-e	7a	7b	8a	Total
20	1	3	0	0	0	0	1	5
19	0	1	0	0	0	0	0	1
18	0	0	1	0	0	0	0	1
17	0	0	0	0	0	0	0	0
16	0	1	3	1	0	0	0	5
15	0	2	1	1	1	0	1	6
14	0	1	2	2	0	0	1	6
13	3	1	1	7	3	0	2	17
12	1	2	3	5	0	0	3	14
11	2	1	3	3	5	1	2	17
10	2	0	3	7	2	1	2	17
9	6	3	5	5	2	0	3	24
8	3	0	0	4	2	3	3	15
7	2	0	1	3	3	0	2	11
6	1	0	0	5	3	4	1	14
5	1	2	0	2	4	3	1	13
4	0	1	1	2	0	8	0	12
3	0	2	1	2	0	0	0	5
2	0	1	0	1	0	2	2	6
1	0	2	0	0	0	0	1	3
0	0	2	0	1	0	3	1	7
Median	9.2	9.8	11.0	9.6	8.8	4.4	9.2	9.1

Table I shows the range of scores and the median of each group taking the test. There was a total score possible of 138. The range of scores was from 5 to 120. The median of the total number of pupils taking the test was 76.8. The highest group median was 92.5 made by a sixth grade. The lowest group median was 50.0 made by a seventh grade. Eleven per cent of the total made scores from 98 to 120. Nineteen per cent of the total made scores from 5 to 52.

Table II A shows the range of scores and the median of each group on Sub-test I. Five students attained a perfect score of 20. Seven students failed to score. The median of the total was 9.1. The highest group median was 11.0 attained by a sixth grade. The low group median was 4.4 made by a seventh grade. Nine per cent of the total made scores from 15 to 20. Twenty-three per cent made scores from 0 to 5.

TABLE II B

RANGE OF SCORES AND THE MEDIAN OF EACH GROUP ON SUB-TEST II

Scores	6a	6b	6c	6d-e	7a	7b	8a	Total
14	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
11	4	0	1	1	2	0	0	8
10	3	0	0	2	1	2	5	13
9	3	0	0	6	0	0	4	13
8	2	7	5	5	2	5	4	30
7	2	5	4	3	4	2	5	25
6	4	2	3	3	3	1	1	17
5	3	0	0	3	3	2	2	13
4	0	0	5	6	0	4	2	17
3	0	1	0	7	6	5	1	20
2	0	3	2	5	2	0	0	12
1	1	3	3	3	2	2	1	15
0	0	4	2	7	0	0	1	14
Median	8.0	6.3	5.7	6.1	5.3	4.8	7.5	5.9

TABLE II C

RANGE OF SCORES AND THE MEDIAN OF EACH GROUP ON SUB-TEST III

Scores	6a	6b	6c	6d-e	7a	7b	8a	Total
42-44	0	0	0	0	0	0	0	0
39-41	0	1	0	0	0	0	0	1
36-38	0	0	0	0	0	0	0	0
33-35	4	0	0	0	0	0	0	4
30-32	9	1	0	2	0	0	2	14
27-29	5	1	0	3	3	0	0	12
24-26	3	1	0	4	6	0	2	16
21-23	1	2	3	1	5	0	3	15
18-20	0	5	4	4	4	0	1	18
15-17	0	3	5	5	3	3	6	25
12-14	0	2	4	7	4	4	6	27
9-11	0	4	3	15	0	5	4	31
6--8	0	2	3	5	0	3	2	15
3--5	0	3	2	2	0	5	0	12
0--2	0	0	1	1	0	4	0	6
Median	30.1	16.0	14.2	12.1	21.4	8.5	15.1	1 5.4

Table II B shows the range of scores and the median of each group on Sub-Test II. A perfect score was 14, but the highest any student scored was 11. The median for the total was 5.9. The highest group median was 8.0 attained by a sixth grade. The low median of 4.8 was made by a seventh grade. Ten per cent of the total made scores from 10 to 11. Forty-six per cent of the total made scores from 0 to 5.

Table II C shows the range of scores and the median of each group on Sub-Test III. A perfect score would have been 44, but no individual scored higher than 39. The median for the total was 15.4. The high group median was 30.1 made by a sixth grade. The low median was 8.5 made by a seventh grade. Six scores of 0 were made. Nine per cent of the total made scores from 30 to 41. Thirty-three per cent of the total made scores from 0 to 11.

TABLE II D

RANGE OF SCORES AND THE MEDIAN OF EACH GROUP ON SUB-TEST IV

Scores	6a	6b	6c	6d-e	7a	7b	8a	Total
20	0	0	0	0	1	0	0	1
19	0	2	0	0	2	0	2	6
18	2	1	1	1	2	0	4	11
17	0	2	3	2	0	1	5	13
16	1	3	3	2	3	2	5	19
15	3	3	1	3	3	1	4	19
14	1	3	2	3	1	4	2	16
13	3	2	0	5	2	0	0	12
12	5	3	7	5	5	3	0	28
11	2	0	4	3	2	2	1	14
10	3	1	0	3	0	0	0	7
9	1	2	0	6	2	2	1	14
8	0	2	2	2	0	0	1	7
7	0	0	1	3	0	0	0	4
6	0	0	1	2	1	1	0	5
5	0	1	0	2	0	0	0	3
4	0	0	0	1	0	0	0	1
3	0	0	0	2	0	0	0	2
2	1	0	0	2	0	3	0	6
1	0	0	0	1	1	2	0	4
0	0	0	0	3	0	2	0	5
Median	12.3	14.0	12.1	10.0	13.3	11.3	16.2	12.4

TABLE II E

RANGE OF SCORES AND THE MEDIAN OF EACH GROUP ON SUB-TEST V

Scores	6a	6b	6c	6d-e	7a	7b	8a	Total
21	1	4	1	4	2	0	1	13
20	2	7	3	4	9	1	5	31
19	4	2	2	5	3	5	6	27
18	6	4	3	3	6	3	4	29
17	4	1	4	6	3	1	5	24
16	3	3	2	9	2	2	2	23
15	1	0	2	3	0	0	1	7
14	1	2	1	0	0	2	0	6
13	0	0	2	1	0	1	1	5
12	0	1	1	1	0	0	0	3
11	0	0	0	1	0	0	0	1
10	0	0	0	2	0	1	0	3
9	0	0	1	1	0	2	0	4
8	0	1	0	0	0	2	0	3
7	0	0	0	1	0	0	0	1
6	0	0	1	0	0	0	1	2
5	0	0	0	1	0	0	0	1
4	0	0	1	3	0	0	0	4
3	0	0	0	3	0	1	0	4
2	0	0	0	1	0	0	0	1
1	0	0	1	1	0	0	0	2
0	0	0	0	1	0	2	0	3
Median	17.8	18.8	16.6	16.1	19.0	15.8	18.3	17.6

TABLE II F

RANGE OF SCORES AND THE MEDIAN OF EACH GROUP ON SUB-TEST VI

Scores	6a	6b	6c	6d-e	7a	7b	8a	Total
19	0	0	1	0	1	0	1	3
18	6	0	1	1	5	2	2	17
17	2	6	4	4	2	0	6	24
16	4	2	1	6	6	6	9	34
15	1	3	7	11	8	5	0	35
14	4	8	1	7	1	2	3	26
13	2	1	4	2	1	1	3	14
12	3	2	2	5	0	1	1	14
11	0	0	2	6	0	2	0	10
10	0	1	2	4	0	1	0	8
9	0	1	0	0	0	0	0	1
8	0	0	0	1	1	0	0	2
7	0	1	0	0	0	1	0	2
6	0	0	0	1	0	1	0	2
5	0	0	0	0	0	1	0	1
4	0	0	0	0	0	0	0	0
3	0	0	0	1	0	0	0	1
2	0	0	0	1	0	0	0	1
1	0	0	0	1	0	0	0	1
0	0	0	0	0	0	0	0	0
Median	15.8	14.3	14.7	14.0	15.8	14.8	16.1	14.9

Table II D shows the range of scores and the median of each group on Sub-Test IV. A perfect score was 20, but only one student attained this score. Five students made a score of 0. The median for the total was 12.4. The highest group median was 16.2 made by the eighth grade. The low group median was 10.0 made by a sixth grade. Thirty-four per cent of the total made scores from 15 to 20. Eleven per cent of the total made scores from 0 to 5.

Table II E shows the range of scores and the median of each group on Sub-Test V. A perfect score was 21 and 13 students attained this score. Three students scored 0. The median for the total was 17.6. The high group median was 19.0 made by a seventh grade and the low group median was 15.8 also made by a seventh grade. Seventy-four per cent of the total made scores from 16 to 21. Eight per cent of the total made scores from 0 to 5.

Table II F shows the range of scores and the median of each group on Sub-Test VI. A perfect score was 19 and three students attained this score. The low individual score was 1. The total median was 14.9. The high group median was 16.1 made by the eighth grade. The low group median was 14.0 made by a sixth grade. Sixty per cent of the total made scores from 15 to 19. Two per cent of the total made scores from 0 to 5.

The following tables are those of the individual item analysis. The item analysis provides the basis for retaining, revising, or rejecting items. An item to be retained in the test must have the power to differentiate between those individuals who possess the necessary skills and those who do not. To determine which items had the necessary power, the technique was used of comparing the tests of the upper 25 per cent with the tests of the lower 25 per cent. Since there were 200 tests, this would mean comparing the upper 50 tests with the lower 50 tests. If the items possessed the power to differentiate, the upper 50 tests would score a much higher percentage of correct responses on each item than would the lower 50 tests. Greene, Jorgensen and Gerberich have this to say about the discriminative power of test items:[1]

> The basic function of all measurement is to place individuals along a scale of ability or achievement in approximate accordance with their real differences in ability or achievement. Such a function implies discriminative power on the part of the test. Since tests are made up of separate items, it is clear that each item comprising a test must have this quality in a maximum degree if the total test is to possess it. Discriminative power in a test or a test item means that a different quality or magnitude of response may be expected from individuals or groups possessing the abilities in question in varying degrees. Pupils with limited ability should fail the item more often than should superior pupils.

1/ Harry A. Greene, Albert N. Jorgensen and J.Raymond Gerberich, Measurement and Evaluation in the Elementary School. Longmans, Green and Company, Inc., New York, 1945, pp.80.

The items on each test were scored as being right or wrong, then transferred into percentages. The Edgerton Tables were used to obtain the standard error and the standard error squared for each item.[1/] From these the standard error of the difference and the critical ratio were figured.

The tables of item analysis showing the critical ratio of each item were based on Mills' statement regarding the element of chance between hypothetical and observed values. Mills says[2/]:

> If a given difference between hypothetical and observed values would occur as a result of chance only one time out of one hundred, or less frequently, we may say the difference is significant. This means that the results are not consistent with the hypothesis we have set up. If the discrepancy between theory and chance might occur more frequently than one time out of one hundred solely because of the play of chance, we may say the difference is not clearly significant. The results are not inconsistent with the hypothesis. The value of T,- the difference between the hypothetical value and the observed mean, in units of the standard error of the mean- corresponding to a probability of one to a hundred,is 2.576. One hundredth part of the area under a normal curve lies at a distance from the mean on the axis of 2.576 standard deviations or more. Accordingly, tests of significance may be applied with direct reference to T, interpreted as a normal deviate. A value of 2.576 or more indicates a significant difference, while a value of less than 2.576 indicates that the results are not inconsistent with the hypothesis in question.

[1/] Harold A. Edgerton and Donald G. Patterson, "Table of Standard Errors and Probable Errors of Percentages for Varying Numbers of Cases," Photostat from Journal of Applied Psychology, Volume 10:378-391, September, 1926.

[2/] Frederick C. Mills, Statistical Methods (revised), Henry Holt and Company, New York, 1938, p.471.

TABLE III A

ITEM ANALYSIS OF SUB-TEST I

Item	Upper 50 tests % of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA*
1	.74	.44	.30	.094	3.191	$\frac{0\text{-U}}{.02\text{-L}}$
2	.92	.68	.24	.076	3.157	$\frac{0}{.02}$
3	.74	.12	.62	.078	7.948	$\frac{0}{.02}$
4	.90	.24	.66	.073	9.041	$\frac{0}{.02}$
5	.78	.54	.24	.092	2.608	$\frac{0}{.02}$
6	.48	.08	.40	.081	4.938	$\frac{0}{.02}$
7	.90	.58	.32	.082	3.902	$\frac{0}{.02}$
8	.96	.70	.26	.071	3.662	$\frac{0}{.02}$
9	.52	.46	.06	.099	0.606	$\frac{0}{.03}$
10	.68	.11	.57	.079	7.215	$\frac{0}{.04}$
11	.84	.26	.58	.081	7.160	$\frac{.02}{.06}$
12	.66	.26	.40	.091	4.397	$\frac{0}{.04}$
13	.46	.18	.28	.089	3.146	$\frac{0}{.10}$
14	.52	.36	.16	.098	1.632	$\frac{0}{.12}$
15	.28	.06	.22	.072	3.055	$\frac{0}{.14}$
16	.28	.04	.24	.064	3.750	$\frac{0}{.14}$
17	.34	.16	.18	.085	2.117	$\frac{0}{.14}$
18	.66	.48	.18	.098	1.836	$\frac{.04}{.14}$
19	.45	.34	.12	.099	1.212	$\frac{.04}{.16}$
20	.28	.04	.24	.064	3.750	$\frac{.04}{.14}$

*Numerator shows percentage of upper 50 tests leaving a blank answer space. Denominator shows percentage of lower 50 tests leaving a blank answer space.

TABLE III B

ITEM ANALYSIS OF SUB-TEST II

Item	Upper 50 tests % of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA.
21	.38	0	.38	.069	5.507	.10 .10
22	.86	.36	.50	.084	5.952	.06 .14
23	.84	.40	.44	.086	5.116	.06 .16
24	.52	.06	.46	.079	5.822	0 .12
25	.86	.34	.52	.083	6.265	.10 .14
26	.74	.20	.54	.084	6.428	.04 .14
27	.66	.14	.52	.083	6.265	.02 .18
28	.74	.38	.34	.093	3.656	0 .18
29	.08	.08	.00	.054	0.000	.30 .28
30	.00	.00	.00	.000	0.000	.32 .30
31	.00	.00	.00	.000	0.000	.32 .30
32	.90	.42	.48	.082	5.853	0 .22
33	.56	.14	.42	.086	4.883	.02 .26
34	.30	.10	.20	.077	2.596	.04 .26

Table III A is the individual item analysis of Sub-Test I. It shows that all items except 9, 14, 17, 18, and 19, have a critical ratio above 2.576 and are significant. Many of the items showed a very high critical ratio, item 4 having a critical ratio of 9.041. The percentage of the upper quarter failing to answer questions was low, ranging from 0 to 4 per cent. The percentage of the lower quarter failing to answer questions ranged from 2 to 16 per cent. Of the five items below 2.576, four of the items, 14, 17, 18, and 19 were questions on the North Polar Map.

Table III B is the individual item analysis of Sub-Test II. It shows that all items except 29, 30, and 31, have a critical ratio above 2.576 and are significant. Item 26 had a critical ratio of 6.428 and many of the others were well above 2.576. Items 29, 30, and 31 were questions on the North Polar map. The percentage of the upper quarter failing to answer questions ranged from 0 to 32 per cent. The percentage of the lower quarter failing to answer questions ranged from 10 to 30 per cent.

TABLE III C

ITEM ANALYSIS OF SUB-TEST III PART A

Item	Upper 50 tests %of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA.
35	.88	.56	.32	.084	3.808	0 .12
36	.82	.24	.58	.081	7.160	0 .14
37	.76	.22	.54	.084	6.428	0 .12
38	.94	.30	.64	.073	8.765	.02 .26
39	.86	.42	.44	.086	5.116	0 .18
40	.98	.48	.50	.074	6.757	0 .12
41	.88	.30	.58	.080	7.250	0 .16
42	.36	.08	.28	.078	3.589	.20 .54
43	.32	.04	.28	.072	3.889	.18 .54
44	.22	.00	.22	.059	3.729	.10 .30
45	.78	.16	.62	.079	7.848	.04 .38
46	.56	.26	.30	.094	3.191	0 .42
47	.72	.02	.70	.066	10.606	0 .20
48	.70	.42	.28	.096	2.916	.02 .24
49	.58	.06	.52	.078	6.667	.02 .28
50	.36	.02	.34	.071	4.788	.26 .66
51	.36	.04	.32	.074	4.324	.22 .70

TABLE III D

ITEM ANALYSIS OF SUB-TEST III PART B

Item	Upper 50 tests % of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA.
52	.60	.08	.52	.079	6.582	.08 .54
53	.64	.08	.56	.078	7.179	.10 .58
54	.26	.10	.16	.075	2.133	.10 .58
55	.22	.08	.14	.070	2.000	.12 .58
56	.04	.00	.04	.028	1.429	.12 .62
57	.18	.04	.14	.061	2.295	.12 .64
58	.54	.06	.48	.079	6.025	.20 .74
59	.50	.00	.50	.071	7.042	.20 .76
60	.50	.02	.48	.074	6.486	.20 .76
61	.48	.00	.48	.071	6.761	.22 .80
62	.12	.06	.06	.058	1.034	.20 .66
63	.52	.24	.28	.093	3.011	.24 .56
64	.12	.00	.12	.046	2.608	.24 .64
65	.15	.02	.14	.056	2.500	.22 .64

TABLE III E

ITEM ANALYSIS OF SUB-TEST III PART C

Item	Upper 50 tests % of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA.
66	.92	.66	.26	.077	3.376	.02 .10
67	.08	.06	.02	.051	0.392	.10 .20
68	.60	.50	.10	.099	1.010	.14 .22
69	.58	.16	.42	.087	4.827	.04 .14
70	.22	.12	.10	.075	1.333	.12 .32
71	.44	.22	.22	.092	2.391	.12 .36
72	.24	.10	.14	.073	1.918	.08 .24
73	.86	.64	.22	.084	2.619	.04 .16
74	.82	.48	.34	.089	3.820	.04 .16
75	.88	.40	.48	.083	5.783	.04 .18
76	.54	.34	.20	.097	2.062	.14 .30
77	.52	.30	.22	.096	2.291	.12 .30
78	.74	.28	.46	.089	5.168	.08 .28

Table III C shows the individual item analysis of Sub-Test III, Part A. It reveals that all items were statistically significant. Some of the critical ratios were very high, only one being below 3.000. The DNA column shows a high percentage of blank answer spaces. The upper quarter had a range of percentage in failing to answer from 0 to 26. The lower quarter had a failing to answer percentage from 12 to 70. On item 50, 66 per cent of the lower quarter failed to answer the question. On item 51, 70 per cent of the lower quarter failed to answer the question. Both these questions were on the North Polar map.

Table III D shows the individual item analysis of Sub-Test III, Part B. It reveals that only 8 of 14 items were statistically significant. In the DNA column the range of percentage was for the upper quarter from 8 to 24. The range for the lower quarter was from 54 to 80. Most of the lower quarter failed to answer the questions on this sub-test.

Table III E shows the individual item analysis of Sub-Test III, Part C. It reveals that only six of 13 items were statistically significant. Items 66, 69, 73, 74, 75, and 78 are significant. The number failing to answer was not so great as in the other two parts of Sub-Test III. The range for the upper quarter was from 2 to 14. The range for the lower quarter was from 10 to 36 per cent.

TABLE III F

ITEM ANALYSIS OF SUB-TEST IV

Item	Upper 50 tests % of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA.
79	.42	.38	.04	.103	0.388	$\frac{0}{.02}$
80	.40	.38	.02	.098	0.204	$\frac{0}{.02}$
81	.36	.12	.24	.082	2.926	$\frac{.02}{.10}$
82	.84	.42	.42	.088	4.772	$\frac{0}{.16}$
83	.90	.38	.52	.081	6.420	$\frac{0}{.16}$
84	.92	.54	.38	.080	4.750	$\frac{0}{.16}$
85	.76	.24	.52	.085	6.117	$\frac{.02}{.16}$
86	.84	.30	.54	.083	6.506	$\frac{.02}{.20}$
87	.94	.46	.48	.078	6.154	$\frac{.02}{.24}$
88	.96	.58	.38	.075	5.066	$\frac{0}{.16}$
89	.94	.52	.42	.079	5.316	$\frac{.02}{.22}$
90	.86	.14	.72	.069	10.434	$\frac{0}{.34}$
91	.80	.18	.62	.079	7.848	$\frac{0}{.40}$
92	.88	.44	.44	.084	5.237	$\frac{0}{.22}$
93	.60	.34	.26	.096	2.708	$\frac{0}{.18}$
94	.70	.16	.54	.083	6.506	$\frac{0}{.18}$
95	.96	.52	.44	.076	5.789	$\frac{0}{.24}$
96	.94	.32	.62	.074	8.378	$\frac{0}{.28}$
97	.52	.34	.18	.098	1.836	$\frac{0}{.16}$
98	.78	.14	.64	.077	8.311	$\frac{0}{.36}$

TABLE III G

ITEM ANALYSIS OF SUB-TEST V

Item	Upper 50 tests % of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA.
99	1.00	.70	.30	.067	4.477	$\frac{0}{.08}$
100	.90	.56	.34	.082	4.146	$\frac{0}{.02}$
101	.80	.30	.50	.087	5.747	$\frac{0}{.24}$
102	.96	.52	.44	.076	5.789	$\frac{0}{.06}$
103	.96	.60	.36	.075	4.800	$\frac{0}{.06}$
104	.90	.64	.26	.080	3.250	$\frac{0}{.08}$
105	.86	.50	.36	.086	4.186	$\frac{0}{.08}$
106	.96	.62	.34	.075	4.533	$\frac{0}{.08}$
107	.60	.22	.38	.091	4.175	$\frac{0}{.26}$
108	.92	.54	.38	.080	4.750	$\frac{.02}{.32}$
109	.98	.60	.38	.072	5.277	$\frac{0}{.16}$
110	.84	.38	.46	.086	5.348	$\frac{0}{.14}$
111	.94	.50	.44	.079	5.569	$\frac{.02}{.24}$
112	.96	.62	.34	.075	4.533	$\frac{0}{.12}$
113	.96	.60	.36	.075	4.800	$\frac{.02}{.18}$
114	.98	.66	.32	.070	4.571	$\frac{.02}{.12}$
115	.92	.56	.36	.080	4.500	$\frac{.02}{.12}$
116	.86	.54	.32	.086	3.721	$\frac{.02}{.18}$
117	.80	.38	.42	.090	4.667	$\frac{.02}{.24}$
118	.96	.46	.50	.075	6.667	$\frac{.02}{.30}$
119	.74	.16	.58	.081	7.160	$\frac{.02}{.30}$

TABLE III H

ITEM ANALYSIS OF SUB-TEST VI

Item	Upper 50 tests % of correct answers	Lower 50 tests % of correct answers	Per cent diff.	S.E. diff.	C.R.	% DNA.
120	.94	.88	.06	.057	1.053	0 .02
121	1.00	.88	.12	.048	2.500	0 .04
122	.80	.48	.32	.091	3.516	.02 .04
123	.98	.90	.08	.047	1.702	0 .06
124	.98	.80	.18	.060	3.000	0 .06
125	.92	.80	.12	.069	1.739	0 .06
126	.98	.56	.42	.073	5.753	0 .12
127	1.00	.82	.18	.056	3.214	0 .04
128	.94	.74	.20	.071	2.816	0 .06
129	1.00	.86	.14	.051	2.745	0 .08
130	.98	.76	.22	.063	3.482	0 .12
131	.94	.78	.16	.068	2.352	0 .14
132	.80	.58	.22	.090	2.444	0 .20
133	.82	.46	.36	.089	4.045	0 .18
134	.80	.42	.38	.090	4.222	0 .28
135	.94	.40	.54	.077	7.013	.02 .24
136	.50	.04	.46	.076	6.052	0 .22
137	.68	.20	.48	.087	5.517	0 .24
138	.22	.04	.18	.065	2.769	.02 .34

Table III F shows the individual item analysis of Sub-Test IV. It reveals that all items except 79, 80, and 97 were statistically significant. Many of the items had high critical ratios, one item having a critical ratio of 10.434. The DNA column shows a range for the upper quarter from 0 to 2 per cent. The range for the lower quarter was from 2 to 40 per cent.

Table III G shows the individual item analysis of Sub-Test V. It reveals that all items are above the critical ratio 2.576 and are statistically significant. On item 99, the upper quarter scored 100 per cent correct responses. The DNA column shows a range for the upper quarter from 0 to 2 per cent. The range for the lower quarter was from 2 to 32 per cent.

Table III H shows the individual item analysis of Sub-Test VI. It reveals that all items except 120, 121, 123, 125, 131, and 132 have a significant critical ratio. On items 121, 127, and 129 the upper quarter scored 100 per cent correct responses. The DNA column shows a range for the upper quarter from 0 to 2 per cent. The range for the lower quarter was from 2 to 34 per cent.

In the following two tables a comparison is made between the I.Q. score, the grade, and the test score in the upper and lower quarters. The assumption is made that, if the total test or any sub-test actually measures knowledge of skills and not intelligence, then regardless of the I.Q. a student possessing the skills would make a higher score than a student not possessing these skills. This would mean that in both upper and lower quarters there would be a range of high, average, and low I.Q. scores.

Complete data on the I.Q. can not be given because of the absence of the I.Q. score on many of the returned test papers. Another harmful factor is that not all the schools represented use the same I.Q. test, but this factor was partially overcome by dividing the I.Q. scores into three groups: over 110, from 90-110, and under 90.

A comparison of grades is made to see how the sixth grade pupils compare with the seventh and eighth grade pupils.

TABLE IV A

RANGE OF I.Q. BY GRADE IN THE UPPER FIFTY TESTS

Score	Grade	I.Q.	Score	Grade	I.Q.
120	6	137	95	6	107
113	6	115	95	6	106
113	8	105	95	6	
111	6	103	94	7	135
110	6	144	94	7	79
106	8	102	93	7	91
106	6		93	6	128
106	6	82	93	6	114
105	6	148	93	6	95
104	6	132	93	6	90
103	6		92	6	95
102	7	121	92	6	
102	6	144	91	6	110
101	7	107	91	6	
101	6	142	90	7	96
101	6	98	90	6	96
99	6	122	89	7	106
99	6		89	7	91
98	7	102	89	6	124
98	6	131	89	6	96
98	6	108	89	6	
98	6		88	8	104
97	8	107	88	7	117
97	7	105	88	7	95
96	6		88	6	

TABLE IV B

RANGE OF I.Q. BY GRADE IN THE LOWER FIFTY TESTS

Score	Grade	I.Q.	Score	Grade	I.Q.
64	6	86	49	6	
63	6	115	48	6	
63	6		47	7	104
63	6		44	6	
62	6	124	43	7	97
61	6	101	43	6	
61	6	74	43	6	
61	6		42	6	
60	7	98	41	6	116
60	6		41	6	90
59	7	83	40	7	97
58	6	115	39	6	
58	7	118	38	6	
58	6		37	6	100
57	6		37	6	
55	7	79	36	7	104
55	6	105	36	6	99
53	6	89	34	6	
53	6		32	6	85
51	7	109	31	7	85
51	7	73	27	7	103
51	6	86	27	6	
50	6		26	6	
50	6		17	6	
49	6	87	5	6	

Table IV A shows the range of I.Q. by grade in the upper quarter. The range of I.Q.'s is 65, the high being 144, the low, 79. There were 4 eighth grade pupils, 12 seventh grade pupils and 34 sixth grade pupils. The I.Q. grouping is as follows:

	6th grade	7th grade	8th grade
Over 110	13	3	0
90 - 110	10	8	4
Under 90	1	1	0
Total	24	12	4

Table IV B shows the range of I.Q.'s by grade in the lower quarter. There were 27 I.Q.'s listed. The range is 51. The high I.Q. being 124, the low, 73. There were no eighth grade pupils, 12 seventh grade pupils, and 38 sixth grade pupils. The I.Q. grouping is as follows:

	6th grade	7th grade	8th grade
Over 110	4	1	0
90 - 110	5	7	0
Under 90	6	4	0
Total	15	12	0

Table IV A and Table IV B reveal that too few seventh and eighth grade pupils took the test really to make a valid comparison with the sixth grade. The results would seem to indicate that the test does measure knowledge and not intelligence. The I.Q. range in the upper quarter was from 144 to 79. In the lower quarter, from 124 to 73.

The results also seem to indicate that the sixth grade pupils are as capable as the seventh and eighth grade pupils. The sixth grade pupils comprised 68 per cent of the upper quarter. They comprised 62½ per cent of the 200 pupils who took the test. The seventh grade pupils comprised 24 per cent of the upper quarter and 25 per cent of the total. The eighth grade pupils comprised 8 per cent of the upper quarter and 12½ per cent of the total.

CHAPTER V

SUMMARY

1. The test measures objectively the skills necessary to get information from a map.

2. The skills are within the ability of the groups tested.

3. Total achievement is low. Group and individual achievement may be high, particularly on certain sub-tests.

4. The sub-tests that the groups showed the greatest weakness on, were sub-tests I, II, and III. Sub-Test III (Knowledge of Latitude and Longitude), showed the greatest lack of knowledge. The pupils were particularly lacking in knowledge on Part B (ability to use longitude to tell time). On this part of the test more than 50 per cent of the lower quarter failed to answer each item. Sub-Test II (use of the scale for measurement of distance), brought in the added problem of arithmetic. It is possible that a pupil may know how to measure distance on a map, yet through faulty arithmetic get the answer wrong.

5. The sub-tests that the groups showed the most ability on were sub-tests IV, V, and VI. The groups were particularly strong on Sub-Test V. This sub-test did not

seem to challenge the pupils, for 13 scored perfect scores, and 74 per cent of the total made scores from 16 to 21.

6. The item analysis revealed that 108 items were significant. Thirty items had a critical ratio below 2.576. The non-significant items were distributed among the sub-tests as follows:

Sub-Test I.	5 items
Sub-Test II.	3 items
Sub-Test III.	
Part A	0 items
Part B	6 items
Part C	7 items
Sub-Test IV.	3 items
Sub-Test V.	0 items
Sub-Test VI.	6 items

On Sub-Test I, four of the five non-significant were questions on the North Polar map. On Sub-Test II, all three non-significant items were questions on the North Polar map. Sub-Test III, Parts B and C show 13 non-significant items. These items were questions based on all maps. The item analysis given in Tables III E and III D[1] shows that these questions were the most difficult for both the upper and the lower quarters. The percentage of correct answers was small,

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[1] See pages 48-49.

and the percentage failing to answer the questions was very high. The results would seem to indicate that these skills had not been taught. On Sub-Test IV there were three non-significant items. These items were answered by about the same percentage of the lower quarter as of the upper quarter. The items need to be rejected or revised. Sub-Test VI shows six non-significant items. Four of these items were questions on Graph I. All the questions were too easy and need revision.

7. It is evident that many of the skills, especially on certain types of projection, have not been taught. Pupils revealed more ability on the better known projections, such as the Mercator. Their performance on the North Polar map was poor, showing unfamiliarity with the map.

8. The results indicate that I.Q. has little bearing on performance if the skill has not been learned. More testing needs to be done to prove this.

9. The general results show a lack of teaching on map skills. Evidently much learning on these skills is incidental.

Suggestions for Further Research

1. The test should be revised, then administered to an equal number of pupils from grades six, seven, and eight. A hundred children from each grade and from different schools from various communities would give a good sampling of the school population.

2. The I. Q.'s should be checked against the performance to show if intelligence is the deciding factor.

3. The abilities of boys could be compared with those of girls.

4. The test could be standardized.

5. The test could be split into two parts. One part would be administered at the beginning of the year, the other part at the end of the year. This would give a measure of progress.

6. Certain of the maps might be revised or eliminated to provide for greater ease of administration.

BIBLIOGRAPHY

BIBLIOGRAPHY

Abrams, A. W., "Observations on Answers to Question Fourteen of the June 1927 Regents' Examination." Bulletin to the Schools. The University of the State of New York.

Aitchison, Alison E., "Torrid, Temperate, and Frigid Zones, Sources of Error in Children's Thinking." Thirty-Second Yearbook, The National Society for the Study of Education, February, 1933, pp.483-485.

Atwood, Wallace W., and Helen G. Thomas, The Americas. Boston: Ginn and Company, 1938.

Baker, Emily V., "Diagnosing Children's Ability to Use Maps." Journal of Geography, Volume 37:227-231, September, 1938.

Barrows, Harlan H., Edith P. Parker and Margaret T. Parker, Geography--Europe and Asia. New York: Silver Burdett and Company, 1927.

Brooks, Winifred, "Exercises in Map Interpretation." Unpublished Master's Thesis, Boston University, School of Education, 1946.

Bureau of Research, New York City. "Testing Map Reading Ability." Journal of Geography, 30:38, January, 1931.

de Grasse, Marjorie, "Use and Meaning of Maps." Unpublished Master's Thesis, Boston University, School of Education, 1946.

Edgerton, Harold A., Donald G. Patterson, "Table of Standard Errors and Probable Errors of Percentages for Varying Numbers of Cases." Journal of Applied Psychology, Vol. 10:378-391, September, 1926.

Greene, Harry A., Albert N. Jorgensen and J. Raymond Gerberich, Measurement and Evaluation in the Elementary School. New York: Longmans, Green and Company, Inc., 1945.

BIBLIOGRAPHY

Howe, George F., "A Study of the Ability of Elementary School Pupils to Read Maps." Thirty-Second Yearbook, The National Society for the Study of Education. February, 1933, pp.486-492.

Hutter, H.K., "Mistakes Made in Geography by Beginning Air Corps Cadets." Journal of Geography, Vol. 43:108-111. March, 1944.

Lange, Stella R., "A Geography Test." Journal of Geography. Vol. 34: 40-41, January, 1935.

Manual for Interpretation of Iowa Every-Pupil Test of Basic Skills. Form L. Boston: Houghton,Mifflin Company, 1940.

McMurry, Frank M. and A.E. Parkings, Elementary Geography. New York: The MacMillan Company, 1928.

Meyer, J.G., O. Stuart Hamer, and Lillian Grisso, The Old World and Its Gifts. Chicago: Follett Publishing Company, 1939.

Mills, Frederick C., Statistical Methods, (revised) New York: Henry Holt and Company, 1938.

Public School Achievement Test, Battery B, Form III. Grades Six to Eight. Bloomington, Illinois: Public School Publishing Company, 1930.

Renner, George T., "The Map as an Educational Instrument." Social Education, Vol. 4, Number 1, 1940, p.477.

Shryock, Clara M., "Gradations in Map Learning." Journal of Geography, Volume 38:5, May, 1939.

Stull, DeForest, Roy W. Hatch, Europe and Europe Overseas. Boston: Allyn and Bacon, 1942.

BIBLIOGRAPHY

Thomas, Katheryne C., "The Ability of Children to Interpret Graphs." Thirty-Second Yearbook, The National Society for the Study of Education, February, 1933, pp.492-494.

Thorp, Mary Tucker, "Studies of the Ability of Pupils in Grades Four, Five, Six, Seven, and Eight to Use the Geographic Tools." Thirty-Second Yearbook, The National Society for the Study of Education, February, 1933. Pp. 494-507.

Uttley, Marguerite, "A Provisional Formulation of Attainments in Geography for the Elementary School." Thirty-Second Yearbook, The National Society for the Study of Education, February, 1933. Pp. 247-264.

Wiedefield-Walther Geography Test. Form A. Grades Four through Eight. Yonkers-on-Hudson,New York: World Book Company, 1931.

APPENDIX

Appendix

Directions for Administering Test

1. This diagnostic map test is divided into six sub-tests.

2. The test may take parts of two or more days to administer. The following schedule is advised.

3. The first day,administer sub-tests I and II. This covers from question 1 through 34 and will take approximately 30 minutes.

4. The second day,administer sub-test III. This is in three parts: A-B-C. It covers from question 35 through 78 and will take about 30 minutes.

5. The third day, administer sub-test IV, V, and VI. This covers the remainder of the test and will take 30 to 35 minutes.

6. When doing sub-test II, give a piece of paper to each student for any figuring that may have to be done. Students may use rulers to measure distance.

7. With each sub-test give out only the maps that go with the test. Maps 1,2,3,4,5, are used with sub-tests I,II,III, and IV. Pattern maps 1,2, 3, 4, are used with sub-test V. Graphs 1,2,and3, are used with sub-test VI.

8. Before starting any part of the test, check to make sure that each student has the correct question sheets and the proper maps.

9. Check the students to make sure that they know where the answers go. Each question is numbered on the left hand side, and the answer space has a corresponding number on the right hand side.

10. Check the students to make sure that they know when to change maps. Each question sheet tells when to change.

11. Do not allow any marking to be done on the maps or the question sheets.

12. Answer any questions before the test starts.

13. There is no time limit, allow all to finish.

14. Have the student put his name at the top left of each question sheet.

15. Have the student fill out the data sheet.

16. The examiner is responsible for filling out the space for the I.Q.

17. When the examiner is sure that all pupils are ready, pencils sharpened, having the proper maps and questions sheets, say-"ready, begin."

Directions for Scoring

1. There is only one correct answer for each question.

2. All blank spaces in the answer column are considered as being wrong.

3. Add up the correct answers for each sheet and place the total at the bottom of each page.

4. When the total test is finished, fill in the spaces on the pupil's data sheet. Each sub-test has two scorings, one for the possible score, and the other for the actual score.

5. Write in the total possible score, and add up the total actual score and place in the correct space.

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